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IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
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MINI X-RAY SOURCE FOR IN-SITU NON-DESTRUCTIVE MATERIALS EXAMINATION IN EXTRATERRESTRIAL RESEARCH APPLICATION

Abstract

Growth of the space industry and mining is strongly dependent on the research and development of industrial technologies adapted to the extraterrestrial harsh environment. This field will be only growing faster because of planned human missions to Moon and Mars which will lead to first in-situ search and manufacturing of metals and alloys, development of first constructions from regolith based concrete and exploitation of advanced heavy machinery. In all of this cases there is demand for non-destructive survey technologies which need to be adapted to use in space application. In nowadays, technology for this type of inspection and analysis X-rays are widely used, however the best developed generation method is use of vacuum tubes. Their weak mechanical properties, need to maintenance and significant power consumption disqualifies them to use them in such demanding environment like outpost on Mars or Moon, where this type of scientific tool is hard to replace. Isotope-based sources in apparatus will also be impractical for bigger scale.

In Compact X we are working on novel device for generation of X-rays. Electron emitter embedded in polyimide-diamond mini vacuum vessel is used to develop smallest X-ray source that is commercially available. Dense layered construction will provide great mechanical and thermal reliability which enables high performance in almost every conditions. Small, low-power X-ray source will have potential to use it as a liable XRF module in minerals-searching drone, in in-situ machinery damage inspection or as a X-ray sources matrix for defects analysis of big surfaces like regolith concrete wall. In this presentation we will show our idea and development status of our minisize X-ray source and open discussion about new possibilities that this type of devices brings in non-destructive survey technologies for space exploration.